

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
DIVISION OF PLANT INDUSTRY BULLETIN No. 629

EFFECT OF VITAMIN K ON THE PRECLIMACTERIC LIFE OF BANANAS

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SUMMARY

Vitamin K shortened the green-life of bananas. It is suggested that the opposite effect reported by Beccari was due to a high level of anthracnose infection in his control treatments.

I. INTRODUCTION

It has been reported (Beccari 1970) that the ripening of bananas can be chemically inhibited by treating them with an emulsion of either vitamin K₁ or vitamin K₃. The effect was obtained initially in a laboratory trial using K₁ and later confirmed, for both K₁ and K₃, during trial shipments of bananas from Somalia to Italy. Treatment of bananas consisted of dipping them in a 0.1% w/v water emulsion or solution for 5 min.

As a chemical having such properties would be of tremendous commercial value, a small investigation was conducted to verify this report.

II. MATERIALS AND METHODS

Bananas used in the investigation (cv. Giant Cavendish) were obtained from the local markets on the day of harvest.

Ten hands of fruit were each broken into single fingers and randomly divided between three treatments:

A—Control—dipped for 5 min in water.

B—Dipped for 5 min in a 0.1% solution (w/v) of vitamin K₃ (Menaphthone, BDH reagent).

C—Dipped for 5 min in a 0.2% solution (w/v) of the same vitamin.

Before the above treatments were applied, all fruits were dipped in 200 p.p.m. benomyl to prevent fungal infection and allowed to dry. After experimental treatment, fruit were again allowed to dry and were then held in a specially designed temperature controlled cabinet which was ventilated with humidified fresh air (>95% R.H.) at a rate in excess of 100 ml/min/fruit. The cabinet was maintained at 20°C. The duration of the preclimacteric phase (i.e. green-life, defined by Peacock and Blake (1970) as the time that elapses until the onset of the respiratory climacteric rise under any defined conditions) was measured as the time that elapsed from harvest until the first detectable change in skin colour occurred.

TABLE 1
EFFECT OF VITAMIN K TREATMENTS ON THE GREEN-LIFE OF BANANAS
 Green-lives shown are means of 5-7 fruit

—	Hand Number	1	2	3	4	5	6	7	8	9	10	Treatment Means (days)
Trial 1—												
Treatment A	Mean green-life (days) ..	19.5	11.2	13.8	15.2	10.1	12.9	16.2	12.3	11.5	13.9	13.66
	S.D.	1.2247	2.9941	0.9832	1.472	2.4721	2.3401	1.8348	2.0587	0.8367	1.9650	
Treatment B	Mean green-life (days) ..	19.7	12.0	15.8	16.3	10.1	11.9	15.8	12.1	11.7	12.3	13.77
	S.D.	1.5055	5.012	0.9832	1.3663	2.848	1.8648	2.137	1.4639	1.9664	2.2361	
Treatment C	Mean green-life (days) ..	18.2	10.2	14.2	14.8	7.0	11.1	14.5	8.7	7.8	9.4	11.59
	S.D.	1.3292	5.0365	1.7224	1.7274	2.958	4.2201	1.8708	4.4615	3.92	4.7167	
Trial 2—												
Treatment A	Mean green-life (days) ..	28.1	17.4	21.3	15.5	18.3	34.8	22.8	16.9	28.6	32.0	23.57
	S.D.	2.2678	6.4129	2.430	4.899	3.7733	1.6021	5.1929	4.2201	4.98	2.000	
Treatment B	Mean green-life (days) ..	28.1	14.1	20.0	17.6	17.1	24.8	20.8	15.6	29.0	26.4	21.35
	S.D.	2.1931	5.743	2.1602	6.7387	2.6726	7.414	3.7639	3.0472	1.5811	2.3705	
Treatment C	Mean green-life (days) ..	26.7	12.9	18.0	16.8	17.3	27.3	20.2	17.3	27.6	26.1	21.02
	S.D.	1.3801	6.5561	2.9439	5.5742	2.9841	1.3663	2.4833	3.6148	1.5166	2.2678	

Levels of significance: Trial 1: A, B > C.
 Trial 2: A > B, C.

The experiment was repeated, however, when unexpected results were obtained in the first trial, but the benomyl treatment was not applied on the second occasion.

III. RESULTS AND DISCUSSION

Contrary to the effect obtained by Beccari (1970), vitamin K₃ was found to shorten the green-life of bananas (Table 1). When this result was obtained from the first replicate, it was thought that it may be the result of some interaction between vitamin K₃ and benomyl or some hydrolysis by-product. For this reason the benomyl treatment was excluded from the second trial.

In the second trial (Table 1), a reduction in green-life was again obtained, thus demonstrating that it cannot be accounted for by a benomyl/vitamin K₃ interaction.

From Beccari's report (1970) it appears that in all of his trials a very high level of anthracnose (causal organism *Colletotrichum musae*) occurred in control treatments. It is believed that the discrepancy between the results reported here and those obtained by Beccari is explainable in terms of this high level of infection. Peacock (1973) has demonstrated that the green-life of bananas can be severely reduced by anthracnose infection, the amount of reduction obtained being dependent on the stage of maturation of the fruit and the level of inoculum. The ethylene production rate of infected bananas was shown to be much higher than controls and was proposed as the cause of the reduced green-life of infected fruit. It has subsequently been demonstrated (Peacock and Muirhead 1973) that *Colletotrichum musae* itself produces ethylene.

Beccari (1970) has reported that vitamins K₁ and K₃ possess anti-fungal activity. It is therefore suggested that the increased green-life obtained by treatment with vitamin K₁ or K₃, as found by Beccari, is solely due to these compounds being effective in controlling anthracnose infection and not through them exerting some influence on the metabolism of the fruit itself.

Had the fungal infection in his control fruit been prevented, it is suggested, their green-life would have been much greater than was obtained, and the results obtained would have been similar to those reported here. Hence, it is proposed that the true effect of vitamin K treatment of bananas is actually a shortening of green-life. No explanation for this effect can be offered.

REFERENCES

- BECCARI, F. (1970).—Banana conditioning during transport, without refrigeration. *Proc. Trop. Prod. Inst. Conf.* 1969:93-7.
- PEACOCK, B. C., and BLAKE, J. R. (1970).—Some effects of non-damaging temperatures on the life and respiratory behaviour of bananas. *Qd J. agric. Anim. Sci.* 27:147-68.
- PEACOCK, B. C. (1973).—Effect of *Colletotrichum musae* infection on the preclimacteric life of bananas. *Qd J. agric. Anim. Sci.* (In press).
- PEACOCK, B. C., and MUIRHEAD, I. F. (1973).—Ethylene production by *Colletotrichum musae*. *Qd J. agric. Anim. Sci.* (In press).

(Received for publication September 19, 1972)

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